

Threatened Species and Communities Risk Assessment

Little Eagle Risk Assessment



July 2021

OFFICIAL

Photo credit

Mel Mitchell

Acknowledgment

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We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.



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1. Summary

The Little Eagle was listed as threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act) in January 2021. This Risk Assessment Report considers risks to this species in the short and long term and whether interim or permanent protections are required.

Under Victoria's modernised Regional Forest Agreements (RFA), the Department of Environment, Land, Water and Planning (DELWP) must, within six months of a species or ecological community being listed as threatened under the Victorian FFG Act or the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999*, undertake a risk assessment where the species or community is or has the potential to be at risk from forestry operations, determine whether additional interim or permanent protections and management actions are necessary, and implement interim protections and actions where relevant.

This risk assessment is built upon the input of species experts combined with information sources including published literature and spatial analysis. The consequence and likelihood of each risk was determined to assess the overall level of risk posed to the Little Eagle by hazards over the next 20 years as they variously apply across the five Victorian RFA regions (Central Highlands, Gippsland, East Gippsland, North East and West), including consideration of the effectiveness of existing controls. It considers whether any of the identified risks (those ranked significant or high) represent an immediate risk of serious or irreversible harm in the short term (next 18 months). Finally, it states whether permanent protections may be required to mitigate the identified significant or high risks in the longer-term.

To qualify for the RFA risk assessment process the Little Eagle must have the potential to be impacted by forestry operations. However, the study found that the following key hazards were considered to most impact the Little Eagle in all RFA regions:

- Bushfires and planned burning: Increased bushfire frequency and severity was assessed as a 'medium' risk to the Little Eagle. Experts concluded that bushfires are likely to incrementally destroy large eucalypt trees needed for nesting and perching. The impacts of bushfires are likely to be most significant in wooded farmland and dry open forest which are the main habitats of Little Eagles. Bushfires may also cause direct mortality during the breeding season.
- Loss of mature trees: Vegetation removal was assessed as a 'significant' risk, and primarily impacts the Little Eagle through the removal of large standing trees, including large paddock trees that provide perching and nesting sites. Vegetation removal may have a greater impact on private land where vegetation is removed for purposes such as firewood, agriculture, and amenity. Commercial forestry is of less concern, as it is conducted mainly in wetter forest types, which are not generally inhabited by Little Eagles.
- Secondary poisoning: Secondary poisoning was assessed as a 'significant' risk because ingestion of poisons through scavenging can lead to death or debilitation. Pindone, an anticoagulant used to control rabbits, is of particular concern because rabbits are a primary food source of the Little Eagle. The widespread use of rodenticides and lead ammunition was also considered as a risk to the Little Eagle.
- Pest control: Pest control was assessed as a 'significant' risk because the Little Eagle relies heavily on invasive species as a food source. Successful attempts to control rabbit populations would significantly reduce the availability of prey to the Little Eagle. Switching to other prey species would not provide adequate food for the Little Eagle due to declines in native birds and mammals.
- Climate change: Experts considered the impacts of climate change on prey availability as a 'significant' risk to the Little Eagle. This was attributed to drying conditions, range shifts and decreased overall ecosystem productivity.
- Vehicle collisions: Vehicle collisions were assessed as a 'medium' risk because Little Eagles often feed on road-killed mammals such as rabbits. Little Eagles are less agile than other small birds and more likely to be struck by vehicles.

Table 1 below lists the hazards together with their level of risk across the RFA regions as determined by this assessment. It is noteworthy that there is only minor variation in the level of risk posed by the hazards across the five regions.

Table 1: Summary of hazards and risk ratings over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Altered fire regimes	Medium	Medium	Medium	Medium	Medium
Loss of mature trees	Significant	Significant	Significant	Significant	Significant
Secondary poisoning	Significant	Significant	Significant	Significant	Significant
Pest control	Significant	Significant	Significant	Significant	Significant
Climate change	Medium	Medium	Medium	Medium	Medium
Collisions with vehicles	Medium	Medium	Medium	Medium	Medium

Assessing risk

The risks posed by the various hazards were assessed on the basis of the likelihood of the hazard impacting on the Little Eagle population over the next 20 years combined with the consequence of any such impacts. A brief description of the risk assessment method is provided in Appendix 2.

Cumulative impacts and interactions between hazards

There are significant interactions between the identified hazards that may limit or exacerbate their individual impacts. There are strong interactions between climate change, altered fire regimes and the loss of mature trees, including the direct impacts of fire and the impacts of fire management activities: construction of roads, fuel breaks and the removal of hazard trees. Subsequent elevated fire frequency may prevent or limit younger trees developing into mature trees, although this effect is likely to occur beyond the 20 year horizon for this risk assessment. Climate change manifesting as more frequent, severe, and protracted droughts may result in reduced biomass of prey species.

Although each hazard has been assessed individually, the cumulative effects of these hazards are likely to pose more significant threats when considered together. Issues such as vehicle collisions and altered fire regimes may not individually cause significant or irreversible damage to the Little Eagle, but they may contribute to its overall decline. However, given the complex operation of each hazard, it is difficult to quantify the cumulative impacts of the hazards considered in this risk assessment.

Requirement for interim or permanent protections

The risk assessment found that the hazards considered are not likely to cause serious or irreversible damage to the Little Eagle in the short-term (18 months). Therefore, there is no requirement for interim protections to manage risk before an evaluation of permanent protections is undertaken. However, noting the reasons for the listing of this species, permanent protections and active management will generally be required to mitigate the impact of any hazard identified at a significant or high risk, and all hazards rated a medium risk or higher will be considered in future management. In many cases, this will involve the maintenance of existing controls; in some cases, further augmentation or adjustment may be required, subject to appropriate evaluation. In a few cases, new protection measures and/or programs of active management may be required.

Flora and Fauna Guarantee action statement

A draft action statement will be prepared prior to January 2023 and will include a detailed evaluation of the permanent protections necessary for the conservation of the Little Eagle.

2. Overview

2.1 Introduction

Under Victoria's modernised Regional Forest Agreements (RFAs), the Department of Environment, Land, Water and Planning must, within six months of a species or ecological community being listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), undertake a risk assessment where the species or community is or has the potential to be at risk from forestry operations. The Little Eagle was listed as threatened under the FFG Act in January 2021.

The Little Eagle is considered to have the potential to be at risk from forestry operations due to a) the extensive overlap of the Little Eagle's likely habitat with areas available for timber harvesting and b) the existence of plausible mechanisms of impact – disturbance of nesting birds during harvesting operations and the loss of mature trees which could limit the availability of nesting and perching sites.

Three experts were asked to assess the level of risk posed to the Little Eagle by hazards over the next 20 years as they variously apply across the five Victorian Regional Forest Agreement regions (Central Highlands, Gippsland, East Gippsland, North East and West), including consideration of the effectiveness of existing controls. They were also asked to assess whether any of the identified risks (those ranked significant or high) represent an immediate risk of serious or irreversible harm in the short term (next 18 months) so that the need for interim or permanent protections could be determined. Finally, they were asked to propose feasible, realistic measures (including regulatory controls, active management and/or further knowledge acquisition) that could be considered to mitigate the identified significant or high risks.

The experts who contributed to this assessment all have extensive experience and specific knowledge of the Little Eagle; they included a university-based researcher, an environmental consultant and a staff member from DELWP.

2.2 Species information

The following description was provided in the Scientific Advisory Committee (SAC) final recommendation report (SAC 2020):

Little Eagles are small, powerful and stocky (45-55 cm) birds of prey with a wingspan of more than 1 m. They have a long tail that is square-cut at the tip when it is closed. Legs are heavily feathered and the feet and talons are powerful. The species' plumage ranges from light to dark brown, with a short crest with a distinctive underwing 'M' in the light morph and a pale, broken 'M' across the upperparts.

Little Eagles are carnivorous, eating mainly rabbits, birds and reptiles. Little Eagles catch prey on the ground by dropping onto it from a prominent perch or from a glide; only rarely is food caught in flight (Emison *et al.* 1987). The species is heavily dependent on rabbits, which are subject to poisoning campaigns.

In Victoria, the species is widespread, and they are most commonly recorded in wooded farmlands and dry woodlands (Emison *et al.* 1987). During the Atlas of Victorian Birds atlas period, the highest reporting rates for the species were in the Mid and Lower Murray Valley where wetlands and irrigated farmlands adjoin River Red Gum woodlands and forests. Little Eagles are absent from areas of high urbanisation and dense forests, and more abundant in open woodland (Marchant & Higgins 1993). Adult breeding Little Eagles are resident in permanent home ranges for at least several consecutive years Debus (2017) and juveniles and individuals are dispersive, travelling up to 2900 km (Rae *et al.* 2019).

Adults breeding in south-eastern Australia (e.g. ACT) migrate to winter in the tropics 3000 km away. (Brawata *et al.* 2018; Rae *et al.* 2019). Little Eagles utilise Yellow Box-Red Gum grassy woodland which is a component of the EPBC Act-listed ecological community: White Box-Yellow Box-Red Gum Grassy Woodland

and Derived Native Grassland. Habitat for the Little Eagle in the South Eastern Highlands bioregion is under ecological stress generally and regional population decline of the species is evident (ACT Government 2013).

2.3 Listing under the Flora and Fauna Guarantee Act

The Little Eagle was assessed by a Scientific Advisory Committee as being eligible for listing under the FFG Act as Vulnerable under Criterion 5.1.1 (equivalent to IUCN Criterion A): *The taxon has undergone, is suspected to have undergone or is likely to undergo in the immediate future a substantial reduction in population size.*

The Committee's final recommendation for listing under the FFG Act (SAC 2020) concluded:

Recent declines of Little Eagle have been seen across Australia - there are few records in the Victorian Biodiversity Atlas (VBA) in the last decade, and the species may be not breeding in some areas. In the first national bird atlas in 1977–81 (Blakers et al. 1984), the Little Eagle was reported in 65% of one-degree grid cells across Australia, with mostly high reporting rates (more than 40% of surveys per grid) across NSW and Victoria. During the second national bird atlas in 1998–2002, the Little Eagle was recorded in 59% of grid cells, at mostly low reporting rates (recorded in less than 20% of surveys per grid). In continental Australia, the species atlas reporting rate for Little Eagles declined by 14% overall, while in NSW a decline of 70% has been recorded over a 20 year time interval (Debus 2017, p. 68). The species is listed under South Australian, New South Wales and ACT legislation and Debus (2017, p. 69) notes that under IUCN listing criteria a >50% decline in index of abundance in three generations suggests the Little Eagle qualifies for Endangered in these jurisdictions. Debus (op. cit.) notes that, since the 1980s in northern NSW, estimated adult mortality of the species has doubled to 10% and life expectancy has halved (to 9.5 years) while estimated life expectancy for the species in the eastern sheep belt is approximately 5 years. Trends in the SE sheep-wheat belt, and in NSW specifically, both for Atlas reporting rates and for breeding productivity and recruitment, are considered by most raptor biologists to be a reasonable indication of what is likely to be happening in Victoria... As the Little Eagle is a resident, territorial species that is long-lived with low breeding productivity, and formerly had a low and stable density, its recent anticipated decline in Victoria may be a long-term process that tracks habitat quality and overall prey biomass rather than a temporary fluctuation caused by short-term climatic variation or the calicivirus-induced decline in rabbits (based on NSW Scientific Committee 2010).

*The main threats to the Little Eagle are inferred to be clearing and degradation of its foraging and breeding habitat, loss of and disturbance to, breeding habitat and nests sites by urbanisation and high density rural subdivision, increased competition with Wedge-tailed Eagles for remaining habitat and anticoagulant rodenticides. Direct human threats to habitat are most evident around expanding provincial cities, where urbanisation and rural/residential expansion are displacing breeding pairs... The loss of habitat and especially breeding sites may bring the Little Eagle into increasing interspecific competition with the larger, dominant Wedge-tailed Eagle *Aquila audax* (Olsen et al. 2010)(see below). There is some evidence that competition with the larger Wedge-tailed Eagle may have had a negative impact of Little Eagles. viz. Fuentes (2005) studying the species in the ACT noted that: 'The Little Eagles abandoned territories that they had during the late 80s and early 90s, and Wedge-tailed Eagles appeared in these areas. Though it is likely that Wedge-tails excluded Little Eagles from these areas, our data is not conclusive.'*

Secondary poisoning from anticoagulants including Pindone (2-pivalyl, 3-indandione) and 1080 (sodium fluoroacetate) used to control rabbits may disable raptors and/or be fatal to them. Pindone has been suggested as the cause of the decline of Little Eagles near Canberra (Olsen et al. 2013). As well as the possibility of mortality, sub-lethal doses may impact on the wellbeing of Little Eagles and affect their survival and breeding success. Additional threats to the species [include] collisions with vehicles, fences (especially barbed wire) and powerlines; shooting (persecution related to predation on free-range or insufficiently protected poultry); and accidental trapping.

2.4 Habitat distribution model and VBA observations

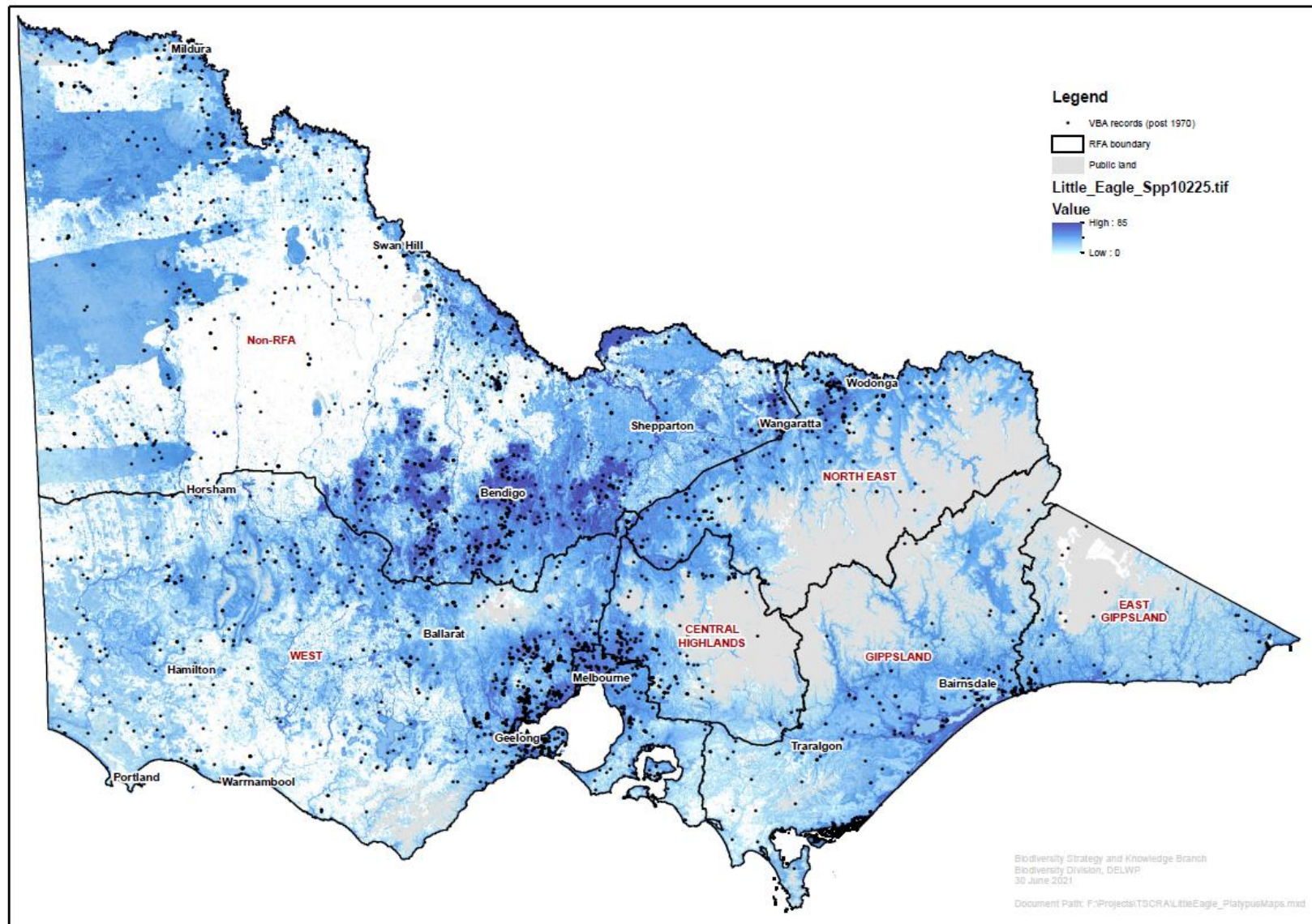


Figure 1. Victorian Little Eagle Habitat Distribution Model with Victorian Biodiversity Atlas (VBA) records. See Appendix 1 for table of data.

3. Key hazards identified in this risk assessment

3.1 Altered fire regimes

3.1.1 Hazard description

Altered fire regimes are now the main threat to many declining bird species, particularly in heath and mallee environments (Woinarski 1999). Despite this, there is very limited research on the temporal and spatial impacts of fire regimes on many bird species, including the Little Eagle (Taylor *et al.* 2012).

Increased bushfire severity and frequency associated with climate change coupled with planned burning are likely to impact Little Eagle populations in RFA regions. The primary impact of bushfire is on active nests in the breeding season, because intense or repeated fires will incrementally destroy large eucalypts needed for successful breeding. Heat or smoke could also cause nestling death, and fire may cause mortality of free-flying eagles. Bushfire impacts are likely to be most significant in wooded farmland and dry open forest or woodland, which are the main habitats of Little Eagles (Emison *et al.* 1987; SAC 2020). One expert noted that significant bushfire could be 'be potentially devastating to eagles, nests and breeding habitat', particularly in dry forests. Bushfires may impact Little Eagles in both isolated trees and groups of trees in habitat patches (Debus *et al.* 2007; Larkin *et al.* 2020).

In relation to planned burning, policies for prescribed burning have the primary goal of reducing risk to human life and property, with a twin goal of conserving biodiversity. One expert noted that, in the last 15 years, planned burning has increased in previously untreated dry forests such as box-gum, box-ironbark and Red Gum forest that are prime Little Eagle habitat. Planned burning may however act to reduce the severity of subsequent bushfires.

3.1.2 RFA regions affected

All RFA regions are affected by bushfires and planned burning. Since 2000, the modelled habitat of the Little Eagle has been moderately affected by bushfires across the RFA regions (between 9-33%), the exception being East Gippsland, where 80 per cent of modelled habitat has been affected.

3.1.3 Evaluation of existing controls

Existing control measures for this hazard include:

- the Victorian Government's Safer Together approach, including fuel management, to reduce the severity of bushfires in Victoria;
- bushfire suppression – coordinated action to limit the extent and severity of bushfires;
- Natural Values and Wildlife Officer roles in most Level 3 Incident Management Teams;
- Biodiversity Risk Assessment role deployed in every Rapid Risk Assessment Team; and
- environmental considerations in Readiness and Response Plans.

Bushfires cannot be prevented in all cases or effectively controlled when weather conditions are unfavourable. Bushfire response is an overriding priority for agencies such as the Country Fire Authority, DELWP and Parks Victoria, but the impacts of bushfires on species such as the Little Eagle cannot always be avoided. Post-fire, rapid biodiversity risk assessment is a valuable recent development, while noting that resource constraints and safety factors may limit and/or delay recovery action.

The overarching *Code of Practice for Bushfire Management on Public Land* has dual objectives: the primary goal is to minimise impacts of bushfire on human life and property; the secondary goal is to maintain the resilience of ecosystems.

Expert input to this risk assessment identified certain deficiencies in the effectiveness of these measures in protecting the Little Eagle:

- protection of individual nest or perching trees is unrealistic in a bushfire situation or indeed generally during planned burning operations;
- few if any protection measures are applied to mitigate impacts on private land; and

- neither the long-term viability of nest trees nor the seasonality of the Little Eagle breeding period (July to January) is given sufficient consideration in areas subject to frequent planned burning.

It should be noted however that the proportion of public land subject to frequent planned burning, typically in asset protection zones and bushfire moderation zones, is relatively small.

3.1.4 Risk assessment

The overall risk level of altered fire regimes is assessed as medium (Table 2): the consequence was assessed as minor to moderate, noting that consequences would be greater in drier forests compared to wetter forests. The likelihood of this impact occurring was assessed as likely over the next 20 years.

Table 2: Risk assessment for altered fire regimes over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Altered fire regimes	Medium	Medium	Medium	Medium	Medium

3.1.5 Urgency

Although altered fire regimes are likely to have a minor to moderate impacts across all RFA regions, there is a low likelihood of serious or irreversible environmental damage prior in the short-term. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.1.6 Potential mitigations

Based on the expert input to this assessment, the following potential mitigations for altered fire regimes may be considered in the further development of permanent protections for the Little Eagle:

- consider the Little Eagle when planning fuel management in dry forests, and investigate options to better protect large trees during bushfire management and prescribed burning;
- surveys and mapping of Little Eagle nest sites across Victoria;
- targeted research and intensive protection based on local surveys may be justified if the species shows longer-term declines;
- identification of active Little Eagle nest sites within forest management areas, and delineating a disturbance-free buffer (exclusion) zone of nominally 200 m radius for the duration of the breeding cycle (nest building/renovation to fledging); and
- where feasible, implement active protection of nest sites in dry forests by removal (e.g. raking) of fuel away from nest trees before planned burns.

3.2 Loss of mature trees

3.2.1 Hazard description

The loss of mature trees, including large paddock trees, primarily impacts the Little Eagle through the reduced availability of perching and nesting sites (SAC 2020). Little Eagles nest in both isolated trees and groups of trees in habitat patches (Debus *et al.* 2007). Therefore, removal of isolated nesting trees and habitat patches is likely to impact the species. The loss of standing trees also increases competition for remaining nest trees amongst large birds, such as Wedge-tailed Eagles (SAC 2020).

Loss of mature trees on private land:

As the Little Eagle inhabits dry forests, woodlands and farmland, the impacts of mature tree loss are greater on private land. Loss occurs due to natural senescence and active removal. There is limited regeneration of trees on private land to compensate for natural senescence, apart from conservation and land management initiatives such as Landcare. Active removal of large on private land is usually associated with change in land use or the adoption of techniques such as a pivot irrigation.

Loss of mature trees on public land:

Loss of mature trees on public land is primarily driven by altered fire regimes and localised active removal during construction and maintenance of infrastructure including roads, fuel breaks, transmission lines, telecommunications and water and gas pipelines. Forestry operations may contribute to the loss of mature trees, although most forestry operations occur in forest types less commonly used by the Little Eagle. The removal of hazard trees during and after bushfires and planned burns for safety reasons also contributes to the loss of mature trees.

3.2.2 RFA regions affected

All RFA regions are affected.

3.2.3 Evaluation of existing controls

Existing control measures for this hazard include:

- the regulation of the removal of native vegetation under the Victorian Planning Provisions and all planning schemes in Victoria;
- support programs such as Landcare for landholders to protect and restore habitat, including remnant patches of native vegetation and isolated paddock trees;
- a policy for protection for large trees in State forest;
- a policy for protection for old-growth forests in State forest; and
- a “values checking” process to protect threatened species and their habitat from avoidable damage during forest management operations, including planned burning, bushfire suppression, strategic fuelbreaks and road construction and maintenance.

While existing controls are considered to be broadly satisfactory, expert input to this assessment identified some important deficiencies as they apply specifically to the Little Eagle, especially on private land:

- there is an ongoing loss of large old trees across the regions, and offsets, while valuable, do not prevent a net loss in the short-term; and
- there is a lack of specific attention to Little Eagle nest sites in the breeding season (August to January).

3.2.4 Risk assessment

The overall risk of mature tree loss is rated as significant (Table 3), noting that the impacts are likely to be higher on private land. The consequence of mature tree loss was assessed as moderate while the likelihood of impacts arising from mature tree loss is assessed as likely. The confidence of this assessments is only moderate, due to insufficient quantitative modelling and historical data to support conclusions. However, it is almost certain that some breeding sites will be lost through native vegetation loss on private and public land.

Table 3: Risk assessment for loss of mature trees over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Loss of mature trees	Significant	Significant	Significant	Significant	Significant

3.2.5 Urgency

The loss of mature trees is not likely to cause serious or irreversible environmental damage in the short-term. The Little Eagle remains widespread in wooded farmland in Victoria, and there is no evidence of urgent decline. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.2.6 Potential mitigations

Based on the expert input to this assessment, the following potential mitigations for loss of mature trees may be considered in the further development of permanent protections for the Little Eagle:

- research, including surveys and mapping of Little Eagle nest sites across Victoria. This includes the identification of active Little Eagle nest sites within forest management areas.

- targeted and intensive protections based on identification of nest sites, such as delineating a disturbance-free buffer (exclusion) zone of nominally 200 m radius for the duration of the breeding cycle (nest building/renovation to fledging). Targeted protection based on local surveys and community interest may offer the best chance for improvements.

3.3 Secondary poisoning

3.3.1 Hazard description

Little Eagles are likely to be impacted by secondary poisoning across public and private land (Olsen *et al.* 2013). Pindone is an anticoagulant which is used to control rabbit populations throughout Victoria. Pindone is used widely in south-eastern Australia because there are fewer restrictions on its authorisation and use than there are for other poisons such as 1080, and there is lower risk to pet dogs and cats as there is an effective antidote.

Secondary poisoning with pindone is of concern to Little Eagles as rabbits represent a significant proportion of their diet (Debus *et al.* 2021; Rae *et al.* 2019). Little Eagles foraging on pindone-poisoned rabbits (dead or alive) could accumulate a lethal dose. Little Eagles could also be potentially affected by ingestion of a sub-lethal dose of pindone. There is some evidence from Wedge-tailed eagles to suggest that a sub-lethal dose of pindone could lead to partial debilitation (Martin *et al.* 1994) and subsequent difficulty catching prey or avoiding other hazards such as collisions with cars or power-lines.

This is supported by evidence of Little Eagle decline in areas where rabbits have increased, despite an increase in available prey (Olsen *et al.* 2013). However, evidence of Little Eagle poisoning is currently anecdotal (e.g. Larkin *et al.* 2020), with no confirmation by tissue analysis of Little Eagle carcasses. The toxicity of pindone to Wedge-tailed Eagles has been experimentally confirmed (Martin *et al.* 1994).

Other poisons that may also carry risks to Little Eagles include rodenticides which are widely used for killing mice (including brodifacoum, flocoumafen, bromadiolone, warfarin and coumatetralyl). These have all been recorded in Tasmanian Wedge-tail eagle carcasses (Pay *et al.* 2021a).

Control of invasive species such as deer using lead ammunition can also cause lead poisoning in eagles scavenging on hunter-killed carcasses (Pay *et al.* 2021b). Tasmanian Wedge-tailed eagle carcasses showed elevated levels of lead, possibly from ingesting ammunition fragments while scavenging on deer carcasses (Pay *et al.* 2021b). Little Eagles also scavenge on deer carcasses.

Increases in invasive species control will increase environmental concentrations of poisons and lead ammunition, and therefore increase the risk of secondary poisoning to Little Eagles. Forestry operations may also create risks associated with pindone and rodenticides where rabbits or rodents are controlled by baiting during restoration.

3.3.2 RFA regions affected

The use of pindone and rodenticides is widespread. Therefore, all RFA regions will be affected, relative to the area of habitat occupied by the Little Eagle and invasive species.

3.3.3 Evaluation of existing controls

An Agricultural Chemical User Permit (ACUP) is required to use Schedule 7 poisons in Victoria, including pindone concentrate of 2.5% or greater, sodium fluoroacetate (1080) and zinc phosphide rodenticide. To hold an ACUP, a person must undertake training depending on the chemical that they intend to use. For pindone, this includes general training units in pest animal control techniques and chemical use. An ACUP is not required for pre-mixed pindone bait products such as oats and carrots or many off the shelf rodent baits.

The controls on pindone and rodenticide use are considered only partially effective because:

- there is no clear policy to use the permit system to limit potential damage to Little Eagles or any other potential victims of secondary poisoning; and
- the requirement for an ACUP does not include prepared pindone bait products or many rodenticides which can be readily purchased at rural supply stores.

In relation to pest control using lead ammunition, there are no explicit controls which may limit the impact of lead poisoning on Little Eagles.

3.3.4 Risk assessment

Based on the expert input to this assessment, the overall risk of secondary poisoning from pindone and rodenticides is considered significant (Table 4): the consequence of secondary poisoning is moderate to major, with widespread poison use across Victoria and potentially lethal impacts on individual birds, and the likelihood of secondary poisoning occurring was assessed as likely, given the widespread use of pindone and SGARs. This assessment is limited by insufficient information on the rate and geography of poison use in Victoria, particularly pindone. Additionally, evidence of secondary poisoning in Little Eagle is currently anecdotal. Lead poisoning was considered by one expert to be of medium overall risk to the Little Eagle: it is possible that lead poisoning might impact the Little Eagle in RFA regions over 20 years but is unlikely to lead to population reduction.

Table 4: Risk assessment for secondary poisoning over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Secondary poisoning	Significant	Significant	Significant	Significant	Significant

3.3.5 Urgency

Secondary poisoning is not likely to cause serious or irreversible damage to the Little Eagle in the short term. Experts considered secondary poisoning as a low-level, long-term hazard rather than acute. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.3.6 Potential mitigations

Based on the expert input to this assessment, the following potential mitigations for secondary poisoning may be considered in the further development of permanent protections for the Little Eagle:

- investigate alternatives to pindone with respect to impact on raptors. These include 1080 for rabbit control and first-generation anticoagulant rodenticides (FGARs) and other options (e.g. zinc phosphide, cholecalciferol) for rodent control; and
- assess the feasibility of restrictions on pindone use in the home ranges of known Little Eagle (e.g. Olsen *et al.* 2013).

3.4 Pest control

3.4.1 Hazard description

Rabbits are the primary food source of the Little Eagle (SAC 2020). Therefore, successful rabbit control is likely to reduce food availability for the Little Eagle. For example, the release of calicivirus has likely had a negative impact on Little Eagle breeding success and survivorship, particularly in arid and semi-arid areas which experienced significant declines in rabbit populations (SAC 2020). If more successful rabbit control methods are developed in the future, reduced food availability may become a significant hazard for Little Eagles, leading to reduced breeding success, reduced survival, and local extinctions.

In addition to rabbits, several other prey species (e.g. Sulphur-crested Cockatoo and other large ground-feeding birds) may be subject to control measures in farmland where they are regarded as agricultural pests.

The diet of Little Eagles contains a variety of other small mammal, bird, reptile (e.g. Lace Monitor) and insect (e.g. cicada) species. However, switching prey to these species is unlikely to provide adequate food for the Little Eagle. Most of the rabbit-sized, or critical weight range, native mammals that would have comprised the Little Eagle's pre-1780 diet are now extinct (or extinct in Victoria). It is also unlikely that species such as Bluetongue Lizards, Stumpy Tail Lizards and Bearded Dragons could replace rabbits as a staple of the diet because they are uncommon and seasonal in Victorian farmland (the primary habitat of the Little Eagle). Experts concluded that it is unlikely that Little Eagles could survive and breed if small native animals were the only prey species available.

3.4.2 RFA regions affected

All RFA regions are affected, relative to the area of habitat occupied by both Little Eagles and invasive prey species.

3.4.3 Evaluation of existing controls

Rabbit control is undertaken for a range of conservation and agricultural reasons. However, the resilience of rabbit populations and limited effectiveness of rabbit control are maintaining an adequate prey base for Little Eagles in some areas.

Currently there are limited measures to encourage increases in alternative native prey species, including mammals re-introduced from other states. Experts note that these activities do not effectively address the risk of prey scarcity where rabbit controls are effective. There are, however, limited examples of reintroductions undertaken at local scale (e.g. Phillip Island Nature Park; Mount Rothwell) and planned elsewhere (e.g. safe havens). Existing predator control actions are also likely to increase native prey available to the Little Eagle, however the extent of this benefit is uncertain.

3.4.4 Risk assessment

Reduced availability of prey through rabbit control is assessed as a significant hazard to the Little Eagle (Table 5), because the likelihood of impacts through reduced prey availability is possible if more effective rabbit control methods are implemented in future, and if so, the impact on the Little Eagle would be major, noting that the confidence in this rating varied among the experts.

Table 5: Risk assessment for rabbit control over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Pest control	Significant	Significant	Significant	Significant	Significant

3.4.5 Urgency

Rabbit control is not likely to cause serious or irreversible damage to the Little Eagle in the short term. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.4.6 Potential mitigations

Based on the expert input to this assessment, the following potential mitigations for altered fire regimes may be considered in the further development of permanent protections for the Little Eagle:

- investigate feasibility of measures to support populations of alternative native prey species, including re-introductions and predator control. The benefits of these management actions would be diverse and would apply to many species in addition to the Little Eagle.

3.5 Climate change

3.5.1 Hazard description

Climate change may impact the Little Eagle through reductions or redistributions in populations of major prey species. Drying conditions (decreases in rainfall overall and less frequent flooding) may lead to decreased ecosystem productivity, including important prey species such as introduced rabbits, native cockatoos and other large ground-feeding birds. Climate change may also drive redistributions of mobile prey species (cockatoos and other birds) to areas where standing water remains available, or where groundwater or floodwater has maintained productivity. Drying conditions may also lead to large tree deaths and therefore reduce availability of nest sites.

3.5.2 RFA regions affected

All RFA regions affected.

3.5.3 Evaluation of existing controls

Existing controls for this hazard include:

- the *Climate Change Act 2017*, which provides Victoria with legislation to manage climate change risks, maximise the opportunities that arise from decisive action, and drives transition to a climate-resilient community and economy with net-zero emissions by 2050;
- Victoria's Climate Change Adaptation Action Plan for the Natural Environment System, which is a system-level adaption action plan developed to respond to the priorities outlined in the *Climate Change Act 2017*, including an assessment of the extent to which existing policy addresses these priorities, and identifying actions to address key gaps.

Experts considered these controls were ineffective with respect to the resilience of the Little Eagle, with no actions targeted at the Little Eagle or similar species.

3.5.4 Risk assessment

Climate change is assessed as a medium overall risk to the Little Eagle (Table 6), because while it is likely that climate change will lead to reduced prey availability, such a reduction caused by climate change will be a minor consequence to the Little Eagle. Experts considered the impacts of climate change on bushfires and planned burning under hazard 3.1. Given that Little Eagles occupy all climatic zones of Australia, they are expected to have a degree of resilience to climate change.

Table 6: Risk assessment for climate change over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Climate change	Medium	Medium	Medium	Medium	Medium

3.5.5 Urgency

Climate change is not likely to cause serious or irreversible damage to the Little Eagle in the short-term. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.5.6 Potential mitigations

No specific mitigations for this species are proposed at a scale relevant to this assessment.

3.6 Collisions with vehicles

3.6.1 Hazard description

Little Eagles often feed on road-killed mammals such as rabbits. They are less agile on the ground than smaller scavenging birds, and so they are more likely to be hit by vehicles. A recent study of band recoveries for Little Eagles found that road-related incidents accounted for 32 per cent of observed deaths or injuries, however this may be attributable to a band recovery bias in areas of human activity (Debus 2015).

Road-killed carrion may be foraged more by Little Eagles in situations where live prey has been reduced by pest control or climate change. The eagles' ability to avoid collisions may be reduced if the birds are suffering from secondary poisoning.

3.6.2 RFA regions affected

All RFA regions affected.

3.6.3 Evaluation of existing controls

No controls are currently available to mitigate this hazard.

3.6.4 Risk assessment

Collisions with vehicles were assessed as a medium overall risk to the Little Eagle (Table 7): there is a high likelihood that vehicle collisions are occurring but this has only minor consequences to overall population size and probability of persistence.

Table 7: Risk assessment for vehicle collisions over the next 20 years

Hazard	Central Highlands	East Gippsland	Gippsland	North East	West
Collisions with vehicles	Medium	Medium	Medium	Medium	Medium

3.6.5 Urgency

Collisions with vehicles are not likely to cause serious or irreversible damage to the Little Eagle in the short-term. Therefore, no interim enforceable protections or priority management actions are required in the short-term before an evaluation of permanent protections is undertaken.

3.6.6 Potential mitigations

No feasible and cost-effective mitigations have been identified for this risk due to the widespread and sporadic incidence of collisions.

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Appendix 1

Spatial information

Table 8: Little Eagle Distribution Statistics

Full Habitat Distribution Model ¹													
Modelled habitat	Victoria	Central Highlands		East Gippsland		Gippsland		North East		West		Non-RFA	
habitat distribution model total (ha; %)	15,241,360	668,078	4%	783,316	5%	1,853,123	12%	1,362,501	9%	4,235,369	28%	6,338,974	42%
habitat distribution model available for forestry operation (ha; %)	237,300	19,982	3%	168,308	21%	23,490	1%	1,635	0%	23,885	1%		
habitat distribution model affected by bushfires since 2000 (ha; %)	2,502,090	158,335	24%	626,570	80%	617,114	33%	244,382	18%	361,346	9%	494,343	8%
habitat distribution model within CAR reserve system (ha; %) w/ prescription	3,529,388	100,182	15%	383,373	49%	550,765	30%	188,502	14%	584,820	14%	1,721,746	27%
Private land	9,943,226	477,692	72%	109,664	14%	1,038,167	56%	1,022,564	75%	3,345,052	79%	3,950,087	62%

¹ DELWP currently has HDMS for over 4000 taxa that predict the distribution and relative likelihood of suitable habitat for each species across Victoria. This covers all terrestrial vertebrate fauna and most vascular plants. HDMS are built using species occurrence records from the Victorian Biodiversity Atlas (VBA) and relating that data to environmental variables, such as soil, prevailing climate and topography to make predictions about the likely distribution of habitat for individual species across Victoria.

Important populations ²													
Important populations total (ha; %)	206,075	6,911	3%	2,439	1%	7,443	4%	16,303	8%	65,535	32%	107,444	52%
Important populations available for forestry operation (ha; %)	60		0%	16	1%		0%		0%	43	0%		
Important populations affected by bushfires since 2000 (ha; %)	6,517	450	7%	658	27%	162	2%	655	4%	2,469	4%	2,124	33%
Important populations within CAR reserve system (ha; %)	43,207	257	4%	742	30%	2,114	28%	3,583	22%	8,752	13%	27,759	64%
Private land	130,180	5,870	85%	1,084	44%	4,426	59%	11,896	73%	48,870	75%	58,035	45%
Post 1970 VBA records (200m buffer) ³													
Post 1970 VBA records total (#; %)	28,382	1,547	6%	734	3%	1,655	6%	2,573	9%	9,066	32%	12,808	45%
Post 1970 VBA records available for forestry operation (#; %)	148	55	4%	52	7%	10	1%		0%	32	0%		
Post 1970 VBA records affected by bushfires since 2000 (#; %)	1,748	226	15%	380	52%	198	12%	256	10%	399	4%	289	2%
Post 1970 VBA records within CAR reserve system (#; %)	6,584	207	13%	342	47%	366	22%	648	25%	1,795	20%	3,226	25%
Private land	17,769	1,107	72%	258	35%	1,049	63%	1,718	67%	6,247	69%	7,391	58%

² Spatial data to determine where important species locations exist so that appropriate management actions can be undertaken to minimise the impacts to these populations during an emergency event. Unpublished.

³ The VBA species observations are a foundation dataset that feeds into some of the many biodiversity tools used in DELWP's everyday decision making - showing where wildlife is now and how this has changed over time. This makes it a core input to the majority of the government's processes and programs that impact native species.

Appendix 2

Summary of methods

These methods are broadly based on the DELWP risk management guidelines but they have been modified for application to an environmental context.

Step 1: Establish the Context

For each species some key information is provided (pre-filled) to set the context for the species or community. This information includes listing status, information on the spatial distribution, fire history and tenure of modelled habitat. A stocktake of relevant literature is also provided.

Experts were asked to:

- provide information about their knowledge of the species;
- provide any recommended further sources of information on the species; and
- provide an overall comment on the accuracy of the species Habitat Distribution Model, Important Populations Data Set and VBA records.

Step 2: Conduct the hazard assessment per RFA region

In this step experts were asked to describe the major hazards operating on the species or community within each RFA region that it occurs. A hazard can apply equally in each region or may vary between regions. Experts were asked to complete one page per hazard per region (or multiple regions if risk and control ratings are equivalent).

Experts were asked to refer to the information provided in Step 1 in making their assessment.

Experts were asked to:

- identify the hazard (see Table 9 below) or describe any additional hazards;
- provide hazard details (i.e. Any additional information on the hazard, if required such as 'only impacts near the Snowy River');
- describe the mechanism of impact of the hazard on the species; and
- provide a statement on the interaction with other hazards.

Step 3: Evaluation of existing controls

A risk assessment should be performed to establish a realistic view of risks requiring consideration and/or treatment within the context of the risk assessment. Therefore, when performing a risk assessment and discussing hazards, the current controls or policy settings should be considered.

For each hazard experts were asked to:

- List the controls currently operating to mitigate the hazard, drawing on the general controls list provided to populate this field with any relevant mechanism;
- Assess the effectiveness of the controls (see Table 10 below); and
- Provide an explanation for the rating of the effectiveness of the existing control.

Step 4: Risk assessment

Current risk assessment is an assessment of the risk rating as it stands today, with consideration of all existing controls currently in place. Experts were asked to assess the consequence on the species if the hazard occurs, given the vulnerability of the species or community to the hazard and the effectiveness of the current controls. Experts were then asked to make a judgement on the likelihood of the hazard having the expected consequence and determine the overall risk level according to the likelihood and consequence scales.

In this step experts were asked to provide the following for each risk listed for each RFA region per species or community:

- Consequence (see Table 11 below);
- Likelihood (see Table 12 below);
- Overall risk level (see Table 13 below); and
- Confidence in assessment (see Table 14 below)

Step 5: Urgency

Experts were asked to assess the likelihood of serious or irreversible environmental damage prior to January 2023 (18 months from the risk assessment) to determine if any interim protections are needed in the short term. Experts were asked to provide:

- Likelihood rating of serious or irreversible damage prior to January 2023 – judgement based on risk in the next 18-months; and
- An explanation of their rating.

Step 6: Potential measures

Risk management is fundamentally about identifying risks and then treating the risks to ensure that the risk profile is kept within a tolerable level. While it is unlikely that the risks will be eliminated entirely, the purpose of treating risks is to achieve an acceptable risk exposure in the most effective and efficient manner.

This step requires experts to identify possible mitigations for the hazards identified in Step 2 where those hazards have been assessed as significant or high overall. We acknowledge that some risks/threats are more manageable than others – if, in the opinion of the assessor, there is no feasible and effective mitigation, this should be stated.

Experts were asked to propose feasible, realistic measures (including regulatory controls, active management and/or further knowledge acquisition) that should be considered to mitigate the identified significant or high risks. Proposed measures could include modifications to existing measures.

Repeat Step 2 – 6 for all relevant hazard/region combinations.

Moderation of risk assessments

A subsequent moderation process was conducted to review all risk assessments to ensure consistency in application of the ratings system. The moderation process involved experienced policy and planning staff to ensure ratings for control effectiveness, consequence and likelihood had been consistently applied, in consultation with expert assessors where relevant.

Reference tables

Table 9: Hazards

The examples of hazards below are drawn from the recommendation reports prepared for the Platypus and Little Eagle prior to their listing under the *Flora and Fauna Guarantee Act 1988*. Other hazards may be relevant.

Hazard
Altered fire regimes
Altered flow regimes
Bushfire events
Climate change (requires explanation of relevant parameter)
Collision with vehicles, fences and powerlines
Competition by native species
Decline in streamflows
Decline in water quality
Entanglement in nets, traps, and litter
Extreme weather events (droughts, floods, storms, extreme temperatures)
Fishing by-catch
Forestry operations
Fragmentation of populations due to in-stream barriers
Habitat loss and degradation (need to specific mechanism)
Loss of genetic diversity
Pest plants and animals – predation, competition, herbivory, trampling, etc.
Pollution (e.g. contamination of sediment by heavy metals)
River regulation
Secondary poisoning by pesticides
Sedimentation
Shooting and trapping
Strategic fuelbreaks and road construction and maintenance
Water extraction

Table 10: Control effectiveness rating

Control Rating	Description
Good	Controls are consistently applied through time and space where the hazard exists and have been demonstrated to be effective.
Satisfactory	Controls are consistently applied through time and space where the hazard exists and appear to be effective but this has not been demonstrated.
Poor	Controls are consistently applied through time and space where the hazard exists but appear not to be effective or have been demonstrated not to be effective. or Controls are not consistently applied through time and space where the hazard exists.
Uncontrolled	No controls are applied where the hazard exists.

Table 11: Consequence descriptions

Category	Descriptors
Extreme	Extent: Impacts on almost all (> 80%) of the extent of the species/community range OR a majority of particularly high value sites. Severity: Very serious effect on the species' persistence, significant reduction in population size and/or associated habitat: species/community likely to go extinct across the range in the <u>RFA region</u> or any of the discrete sub-populations within a region within the timeframe due to the hazard Duration: Impacts expected to endure over a long time period (e.g. 20 + years) or populations are not expected to recover
Major	Extent: Impacts on a large proportion (60-80%) of the extent of the species /community range or a major amount of high value sites Severity: major effect on the species or community persistence, major reduction in population size and/or associated habitat, species/community may be threatened with extinction across the range in the RFA region or any of the discrete sub populations within the region. Duration: Impacts expected to endure over a major time period 10-20 years
Moderate	Extent: Impacts on moderate proportion (30-60%) of the extent of the species /community range or a moderate amount of high value sites Severity: Moderate effect on the species or community persistence, may be a reduction in population size, unlikely to be threatened with extinction from this hazard Duration: Impacts expected to endure over a moderate time period 5-10 years
Minor	Extent: Limited impacted on the extent of the species/community range (10-30%) or high value sites Severity: minor effect on the species or community persistence, unlikely to lead to population reduction Duration: Impacts expected to endure over a short time period 1-4 years
Negligible	Extent: Negligible effect on the extent of the species/community range, Contained locally within a single site/area Severity: Negligible effect on the species or community persistence: Duration: Impacts expected to endure for a negligible time period and/or under 1 year.

Table 12: Likelihood Descriptors

Rating	Description
Almost Certain	The hazard is expected to occur constantly or frequently within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence. In the case of an isolated event, the probability of occurrence is >80% over 20 years at a scale that will cause the expected consequence.
Likely	The hazard is likely to occur in most circumstances within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence. In the case of an isolated event, the probability of occurrence is 50-80% over 20 years at a scale that will cause the expected consequence.
Possible	The hazard might occur within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence. In the case of an isolated event, the probability of occurrence is 20-49% over 20 years at a scale that will cause the expected consequence.
Unlikely	The hazard is unlikely to occur within a species' habitat or community extent over 20 years at a scale that will cause the expected consequence. In the case of an isolated event, the probability of occurrence is 5-19% over 20 years at a scale that will cause the expected consequence.
Rare	The hazard may only occur in exceptional circumstances. In the case of an isolated event, the probability of occurrence is <5% over 20 years at a scale that will cause the expected consequence.

Table 13: Risk matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Extreme
Almost Certain	Medium	Significant	High	High	High
Likely	Medium	Medium	Significant	High	High
Possible	Low	Medium	Medium	Significant	High
Unlikely	Low	Low	Medium	Medium	Significant
Rare	Low	Low	Low	Medium	Significant

Table 14: Confidence in risk assessment⁴

Confidence level	Descriptor	Supporting evidence
Highest	Assessed likelihood, consequence or risk is easily assessed to one level, with almost no uncertainty	Recent historical event of similar magnitude to that being assessed in the community of interest or Quantitative modelling and analysis of highest quality and length of data relating directly to the affected community, used to derive results of direct relevance to the scenario being assessed
High	Assessed likelihood, consequence or risk has only one level, but with some uncertainty in the assessment	Recent historical event of similar magnitude to that being assessed in a directly comparable community of interest or Quantitative modelling and analysis use sufficient quality and length of data to derive results of direct relevance to the event being assessed
Moderate	Assessed likelihood, consequence or risk could be one of two levels, with significant uncertainty	Historical event of similar magnitude to that being assessed in a comparable community of interest or Quantitative modelling and analysis with reasonable extrapolation of data required to derive results of direct relevance to the event being assessed
Low	Assessed likelihood, consequence or risk could be one of three or more levels, with major uncertainty	Some comparable historical events through anecdotal information or Quantitative modelling and analysis with extensive extrapolation of data required to derive results of relevance to the event being assessed
Lowest	Assessed likelihood, consequence or risk could be one of four or more levels, with fundamental uncertainty	No historical events or quantitative modelled results to support the levels

4. National Emergency Risk Assessment Guidelines Handbook “: Confidence level descriptions” (page 42), Australian Institute for Disaster Resilience